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ABSTRACT

This module for a 1-semester Total Quality Management (TQM) course for high school or community college students covers the topics of benchmarking and the continuous improvement process. It includes the following components: (1) a narrative summary of the topics; (2) a discussion of benchmarking; (3) a benchmarking exercise (the "numbered ball" game); (4) a discussion of the continuous improvement process; (5) the Tenner and DeTorro Six Step Improvement Model; (6) a process improvement example; and (7) a discussion of pitfalls to process improvement. A bibliography lists six references. (KC)

TOTAL QUALITY MANAGEMENT (TQM):

TRAINING MODULE

ON

" CONTINUOUS IMPROVEMENT "

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CONTINUOUS IMPROVEMENT

CONTENTS:

CONTINUOUS IMPROVEMENT

INTRODUCTION:

The topics in this module are on Benchmarking and Continuous Improvement. These concepts can be presented as a stand alone presentation, but they will be more effective when they interface with the other TQM concepts: customer satisfaction, empowerment and teamwork.

Continuous Improvement is especially effective if it is presented in conjunction with or after the module on problem solving. The skills and tools learned during the problem solving module are key to the effective use of the continuous improvement process.

The benchmarking process will provide a method for determining another group or organization's "best practices". The "numbered ball" exercise is a good exercise for showing the methodology for measuring and making continuous improvements, but it is particularly useful in showing people that once they have learned what the "benchmark" time is, they can make further improvements.

The instructor may choose to use either of the continuous improvement processes. The process improvement example should help reinforce the theory.

In teaching this module, you may want to use teams of students working on individual processes so that they can become comfortable with the process.

It must be remembered that the continuous improvement process is a process and not a "one-time" operation.

CONTINUOUS IMPROVEMENT

NARRATIVE:

The module on Continuous Improvement will contain two major categories. The first major category will be Benchmarking and the second major category will be the Continuous Improvement Process.

Benchmarking is a process by which ideas are taken from other companies, or schools in the case of education, to see what they are doing better. It is actually looking at other organizations to see where they do things very well and copying their ideas and improving upon them. One of the best business examples of benchmarking in this country was with Xerox Corporation.

In the mid-1970's, Xerox found themselves at a disadvantage competitively. They found the Japanese could bring a "desk-top" copier into the United Stated and sell it for what it was costing Xerox to manufacture it in the United States. Xerox determined at that time, that in order for them to be able to compete in this country, they would have to understand how the Japanese did what they did.

Xerox looked at all the processes the Japanese used to manufacture their copier. They looked at the number of parts used, the technology used to manufacture it, the distribution system, their management structure and even their service strategies. As a result of this, Xerox completely reorganized their company and redesigned their copier. The result has been a much improved copier as well as a competitive advantage for Xerox at this time. Currently Xerox has been able to regain their share of the "desk-top" copier market and even increase it in the years.

A good educational example of benchmarking is in athletics. It is very common for coaches to look at the ideas of other coaches and see where they have been successful. The coaches will then bring these ideas back to their own school(s) and improve upon them in order to improve their athletic teams. This idea of benchmarking is now going into the classroom. More teachers are taking time to read journals and actually visit other schools to see how they are doing things. This process of looking at what other people are doing, bringing an idea back into your own organization, taking that idea, using it and actually improving upon it is the process of "benchmarking."

In Robert Camp's book, "Benchmarking", he defines four types of benchmarking:

- The first type is "internal benchmarking" where you would benchmark within your own organization. This tends to be the easiest type.

- The second type is "competitive benchmarking" where you look at someone that's using a similar process to yours, whether in another school within your district or perhaps another district.

- A third type of benchmarking is called "functional benchmarking". This type is best described by an industrial example. When Xerox was interested in improving the delivery of small parts to their service technicians they benchmarked L.L.Bean which is a leader in "order delivery."

- The fourth type is "Generic benchmarking." This is a pure form of benchmarking where the best ideas throughout industry or education would be benchmarked. These may not even be directly applicable to your own situation but, with investigation, many ideas from this "best-of-the-best" or, sometimes called, "world class benchmarking" could be used in your own organization.

There is a ten-step process called "The Benchmarking Process" on page 15. This is a process which Xerox used. I will not go into the process in detail in this narrative, but the phases are planning, analysis, integration and action. In summary, you start off with what needs to be benchmarked, find locations whether they be other schools or a class within your own school to benchmark. You then decide what data needs to be collected and determine what the current gap is between what they are able to achieve and what you are able to achieve. An example of this would be "class attendance". Perhaps your class is only able to achieve 92% attendance whereas you know of another class in your school that is able to achieve 98% attendance. You could benchmark how they do this. The gap would be the difference between your 92% and their 98%. Once you determine how they do what they're doing, you would them project what you think your organization could do and then get commitment from other people within your organization to implement these new ideas. This would require some action plans and then actually implementing these new ideas and monitoring their progress. After this process is over you could, what is called recalibrate, or look at the results of these ideas.

The concept of benchmarking is a very useful tool. An exercise called the "Numbered Ball Game" is included in this module. Although the "Numbered Ball Game" can be used as a tool for demonstrating continuous improvement, as it should, it can also be a very strong tool for showing the effect of benchmarking.

The "Numbered Ball Game" is designed to give a group of people, or team, an opportunity to go through an exercise and show continuous improvement by changing the way they perform their process. The instructions are in the module and can be followed. In practice, this exercise allows a team to decrease the time it takes to touch each of the balls, usually down into the neighborhood of 3 - 4 seconds. After the teams have been working on this exercise for perhaps 15 - 20 minutes they will have reached what they consider to be about as good as they can do, which is usually about 2 - 3 seconds. At that time the facilitator can encourage them by using words such as, "I have seen this done in less than half a second." This usually results in a marked improvement. Most teams are able to get their time down to less than one second. This demonstrates that if a benchmark (in this case one-half second) is known, the teams are able to make drastic improvement.

The section on the Continuous Improvement Process actually contains two separate processes:

- The Xerox Process. The first process is the one that is known as "the Xerox process" and came out of the Xerox training material. This will not be described in this narrative but it can be reviewed in the module and is a very useful process. You will be able to understand the relationship between the quality improvement process and the problem solving graphically by looking at the process flow diagram on page 30.

- The Continuous Improvement Process. The quality improvement process, as such, is a very powerful tool. What must be remembered in doing the continuous improvement is that continuous improvement never ends but rather is a continuing process. The goal should be perfection, zero defects, 100% good or, in the school environment, everyone passing. Since it is very rare to find 100% good or zero defects, an institutionalized process is needed in order to keep working toward this goal of perfection. The continuous improvement process is such a methodology.

Arthur R Tenner and Irving J. DeTorro in their book, "Total Quality Management" describe a six-step process by which improvements can be made. They describe this as "process improvement". These six steps are described on page 35 in this module. They can be summarized as a) determining the process that requires improvement, b) documenting this process and c) measuring the performance of the critical parameters of the process. Once the parameters determined, analysis using the tools of problem solving can be used to understand why the process is not yielding the required output. The use of the problem solving process allows whoever is doing the work to develop new potential solutions or new ideas that will improve the process. The continuous improvement process itself allows for these ideas to be implemented and monitored. In problem solving, this implementation would be the end of the process, whereas in the process of continuous improvement, the results are measured against the original output of the process and the complete process is recycled to make continuous improvements. Again, this is a continuous improvement process and the improvements tend to be incremental.

An example is used to demonstrate the continuous improvement process. In the example, Algebra II teachers in Banner High School found that many of the students entering their class were not adequately prepared. These teachers were having to spend six weeks in remediation in order to prepare the students for Algebra II. Using the six-step process by Tenner and DeToro, they solved the problem as follows:

- Step 1: Define the Problem. Using the six-step process by Tenner and DeToro they defined the problem. Looking on page 48 you can see the definition of the problem. A key point in defining the problem is to find an owner of a problem. If an owner of a problem cannot be defined it is very difficult to make improvements to a process. Each process must have one owner. Joint ownership can add confusion to the process and will usually keep true improvements from being made. Defining the process and the process owner are very key points in the continuous improvement process.

- Step 2: Identify and Document. Once a problem has been defined, step two is to identify and document the process. The use of flowcharts is a very helpful tool in defining a process. If a person can use flowcharts to define a process this usually means they understand the process. These flowcharts do not need to be elaborate or fancy. They can be very straight forward and simple. The one used in this example is probably over simplified but it is used to point out the use of the flowchart. Using the flowchart will show where there are duplicate steps and where there seem to be very complex processes that can be simplified.

- Step 3: Measure. Once a process has been defined, the output of the process steps that are "key" should be measured. This will provide a base line for improvement. In this example, 80% of the students were able to master the competencies on the pre-test. This is a base line that can be improved. Obviously, the goal in this case was to reach 100% mastery.

- Step 4: Understand Why. Two approaches can be used on Step 4 which is "understanding why".

  a. The first approach should be used when there is actual data that can be analyzed. If there is data that can be analyzed, pareto charts, histograms and check sheets can be used to determine the cause of the problem.

  b. If there is not data available, the use of the cause/effect or "wishbone" diagram can be used to determine the potential cause of the problem.

One concept that's used in this continuous improvement process is called "root cause analysis". This actually takes the problem down to its base or root cause. An example should help define "root cause" analysis. In this case, let's look at students not passing tests. The first analysis of this could be the that students aren't doing their homework and therefore are not prepared for the test. Going a step further, you may ask, "Why haven't they done their homework?" There could be many problems here but for the sake of this example, let's say a major problem would be, "they don't have time to do their homework because they work." This could lead to the root cause being that the students are working and not providing enough time for homework. Therefore, they don't do their homework and don't have time to study. The end result being they are failing their test(s). Again, the "root cause" is the actual cause of the problem, not necessarily the symptom. In many cases we look at the highest level of the problem, or in many cases, the symptom, and are not truly solving the problem.

In step four, "Understanding Why", it's very important that you go down several levels to get to the "root cause" of the problem. In understanding why the students are not meeting their competencies, the teachers actually had some data. The data is shown on the chart on page 49, where the results of a pre-test that the Algebra II teachers had given, showed clearly that three of the schools, Alamo Flats, River View and Roosevelt tend to have good pre-test scores but the middle school, Farwell, had only a 50% mastery. Using the "root cause" analysis it is necessary to go beyond understanding that Farwell is the cause of the problem. It is necessary to understand why Farwell students were not mastering the content as well as the other students.

In the first analysis, when going to Farwell, it was found that the teachers in the Algebra I classes were only teaching 5 of the 8 competencies. You would put a solution in place and have them teach the other 3, but this is not the "root cause" of the problem. In this case, the "root cause" is actually that the teachers at the middle schools and the teachers at the high schools have not been working together to truly understand what is needed at the high school.

Here is an example of where you could solve the symptom of the problem and actually teach the other 3 competencies but in the long term other problems could occur. It is critical to put solutions in place for the "root causes" as well as the symptoms.

- Step 5: Test Ideas. In the example, as part of step 5, which is "Testing Ideas", two ideas were put in place. One of these was to use the pre-test the Algebra II teachers were using at the high school as a post-test for the middle school Algebra I classes. This would give the Algebra I teachers an opportunity to find out where there are problems and actually do their own

improvements in their classes without having to wait until they get to the high school level. The second solution that was put in place was to have all middle school math teachers and high school math teachers work together once a year to ensure there programs were compatible and all the things were being taught that needed to be. This second solution should resolve the "root cause" of the problem.

- Step 6: Implement a Solution. Step six would be to implement the solution and evaluate the results. It is important to do a "pilot" project of the implementation. In this case, Farwell implemented the "pilot" as a post-test for their class. They were able to show improvements with this and therefore, after one year, post-testing was evaluated and it was implemented across all of the middle schools in the school district.

  In this case, the teachers did not get to 100% mastery of their pre-tests. They would continue to look at other reasons why 100% mastery wasn't achieved. The next analysis they might do would be to look at which particular parts of the pre-test were not being mastered and go back into the curriculum of the middle schools to see what could be done to improve that particular part of the curriculum.

  (Hopefully, this example will give a person a better understanding of the continuous improvement process.)

As can be seen, the continuous improvement process is never really ended. It is important to look at the major causes of the problems that keep the process from yielding what is needed and then continue to work on these major problems until they are solved. Once the major causes are resolved, the progressively less significant causes can be addressed.

The continuous improvement process is a very powerful tool if used in conjunction with understanding and meeting the customer's needs. As in many aspects of Total Quality Management, it is impossible to make each segment "stand alone" and get the benefits that can be obtained by looking at more than one aspect of TQM.

" BENCHMARKING "

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June 1, 1993

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" IF YOU ALWAYS DO WHAT YOU ALWAYS DID, YOU'LL ALWAYS GET WHAT YOU ALWAYS GOT. "

--- Anonymous

CUSTOMER SATISFACTION

FOUR TYPES OF BENCHMARKING:

1. INTERNAL:

One of the easiest benchmarking investigations is to compare operations among functions within your own organization.

2. COMPETITIVE:

Direct product or service competitors are the most obvious to benchmark against.

3. FUNCTIONAL:

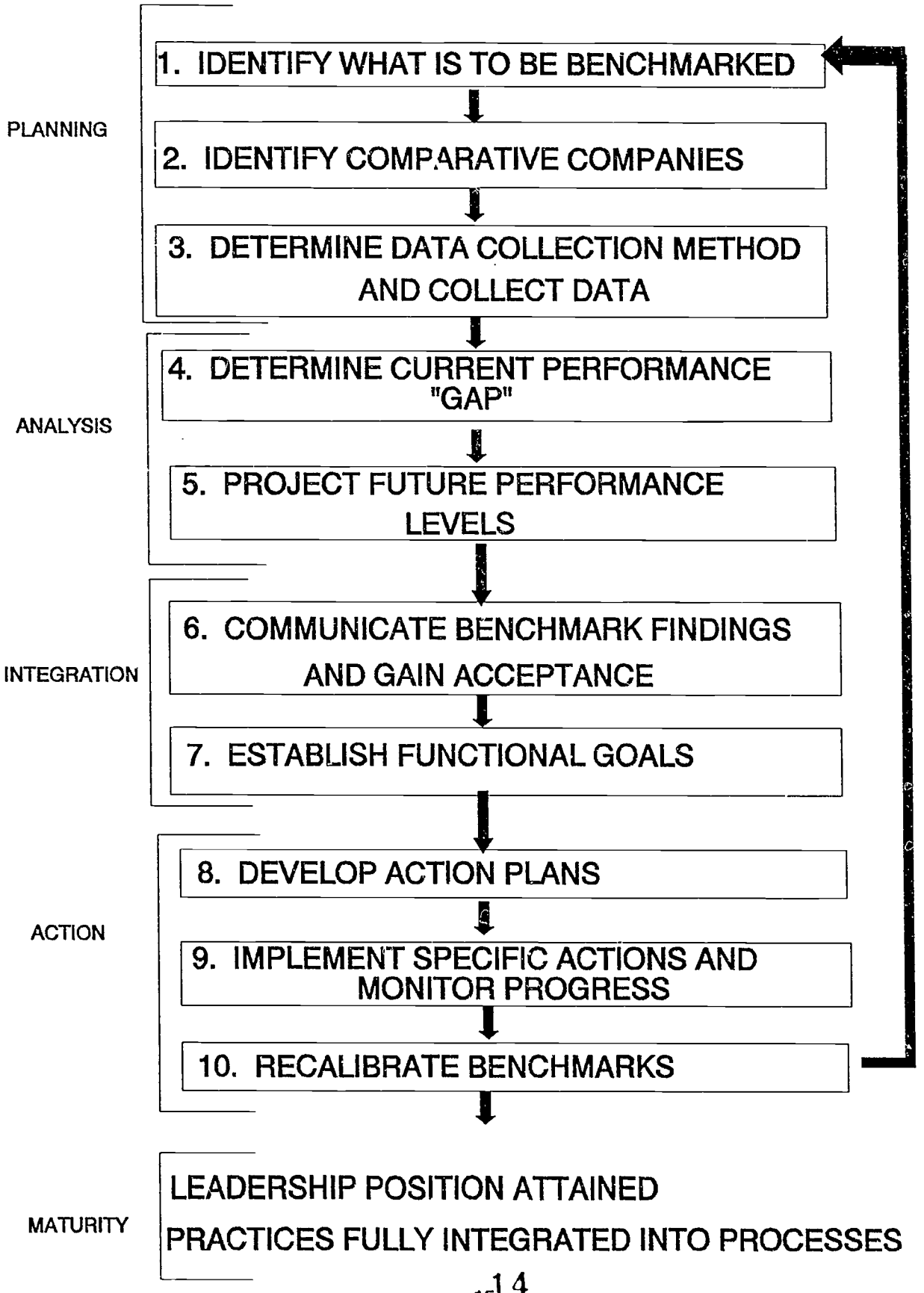
It is not necessary to limit comparisons to direct competitors. In fact, a narrow focus may risk missing potential breakthroughs. (An example is that Xerox was interested in improving the delivery of small parts to service technicians, therefore they benchmarked L.L. Bean as the leader in order delivery.)

4. GENERIC:

Some business functions and processes are the same regardless of dissimilarities across industries. This generic benchmarking is the purest form of benchmarking and holds the potential for revealing the "best of the best."

-- Robert C. Camp, Benchmarking

BENCHMARKING PROCESS



TOTAL QUALITY MANAGEMENT (TQM)

"NUMBERED BALL" EXERCISE

CONTENTS:

COMPETENCY PORTFOLIO

("NUMBERED BALL" EXERCISE)

COMPETENCY	TOTAL QUALITY LEARNING MATRIX					
	KNOW-LEDGE	KNOW-HOW	WISDOM			
	KNOW-LEDGE	COMPRE-HENSION	APPLICA-TION	ANALYSIS	SYNTHESIS	EVALUA-TION
CONTINUOUS IMPROVEMENT	X	X	X	X		
TEAMWORK	X	X	X			
BENCHMARKING	X	X	X	X		
MEASUREMENT AND ASSESSMENT	X	X	X			
BRAINSTORMING	X	X	X			
STATISTICAL TECHNIQUES	X					

CONTINUOUS IMPROVEMENT EXERCISE

(THE NUMBERED BALL GAME)

TQM PRINCIPLES DEMONSTRATED:

1. Continuous Improvement
2. Teamwork
3. Quality Measurement / Assessment
4. Benchmarking
5. Tools:
    A. Brainstorming
    B. Statistical Techniques

CONTINUOUS IMPROVEMENT EXERCISE

(THE NUMBERED BALL GAME)

LEARNING POINTS:

1. The student will gain the opportunity to observe that a process can gain continuous improvement through following the Shewart Cycle (plan, do, study, action).

2. The student should be able to see that, by using the tool of brainstorming, good ideas can be developed quicker than by working alone.

3. The student will gain experience in taking measurements and placing these measurements on a chart.

4. The student will gain an appreciation for the need to benchmark other similar processes. They will observe that, once benchmarking is done, major improvements can be made in their process.

CONTINUOUS IMPROVEMENT EXERCISE

(THE NUMBERED BALL GAME)

FACILITATOR'S INSTRUCTIONS:

1. Introduce this exercise as an opportunity for the class to learn more about the principle of continuous improvement by playing a game.

2. Divide the class into teams with from 4 to 8 members in each team. Provide each team with a place to work where they will not be able to see the other teams. (The teams should not have any interaction during the game.)

3. Instruct each person not to talk to people who have not taken this class about this game. The other people will not learn as much if they have the benefit of your class member's knowledge.

4. Give each team a set of balls numbered from 1 to 6 (If the team has less than 6 members, give each person on the team one ball.). Also provide each team with a stopwatch, a copy of the rules and a chart for keeping time measurements.

5. Instruct the class that they will have 30 minutes to complete the game.

6. Make yourself available to answer any questions that the teams may have prior to the start of the game and during the period of the game. DO NOT interpret the rules! Let each team determine what the rules mean.

7. Walk around and observe each team in action. If the teams have clearly misinterpreted the rules, help them out by making clarifications. Do not tell the teams how good they are doing. (they will probably ask)

FACILITATOR'S INSTRUCTIONS: (Continued)

8. After 20 minutes have passed, go to each team and tell them that another team has been able to complete the exercise in less than 1/2 second.

9. Have all the students reconvene after the 30 minutes are over. Ask the class what they learned from the exercise that was just completed.

10. After sufficient discussion, explain to the class that they have had an opportunity to gain experience in several different principles of TQM, such as the Shewhart Cycle, continuous improvement, brainstorming, assessment, and teamwork. Point out that the main point of this exercise is to show the importance of benchmarking and how major improvements can be made once you find out that "someone else can do it."

CONTINUOUS IMPROVEMENT EXERCISE

(THE NUMBERED BALL GAME)

RULES: (30 Minute Time Limit)

1. Each team member must touch each ball in sequential order (1 - 6), but can only touch one ball at a time.

2. The balls must be held during the time trials.

3. Two people can't touch the same ball at the same time except the person holding the ball.

4. Discuss methods for performing this exercise with all team members before timing any of your efforts.

5. Establish your process for performing the task.

6. Test out your defined process before you take a time measurement.

7. Time your process using a stopwatch. The process time will start when a team member says, "Go" and will end as soon as the final team member touches the last ball.

8. Record the time on a piece of paper. You may take as many measurements as you wish, but do not modify your process. Record the fastest time.

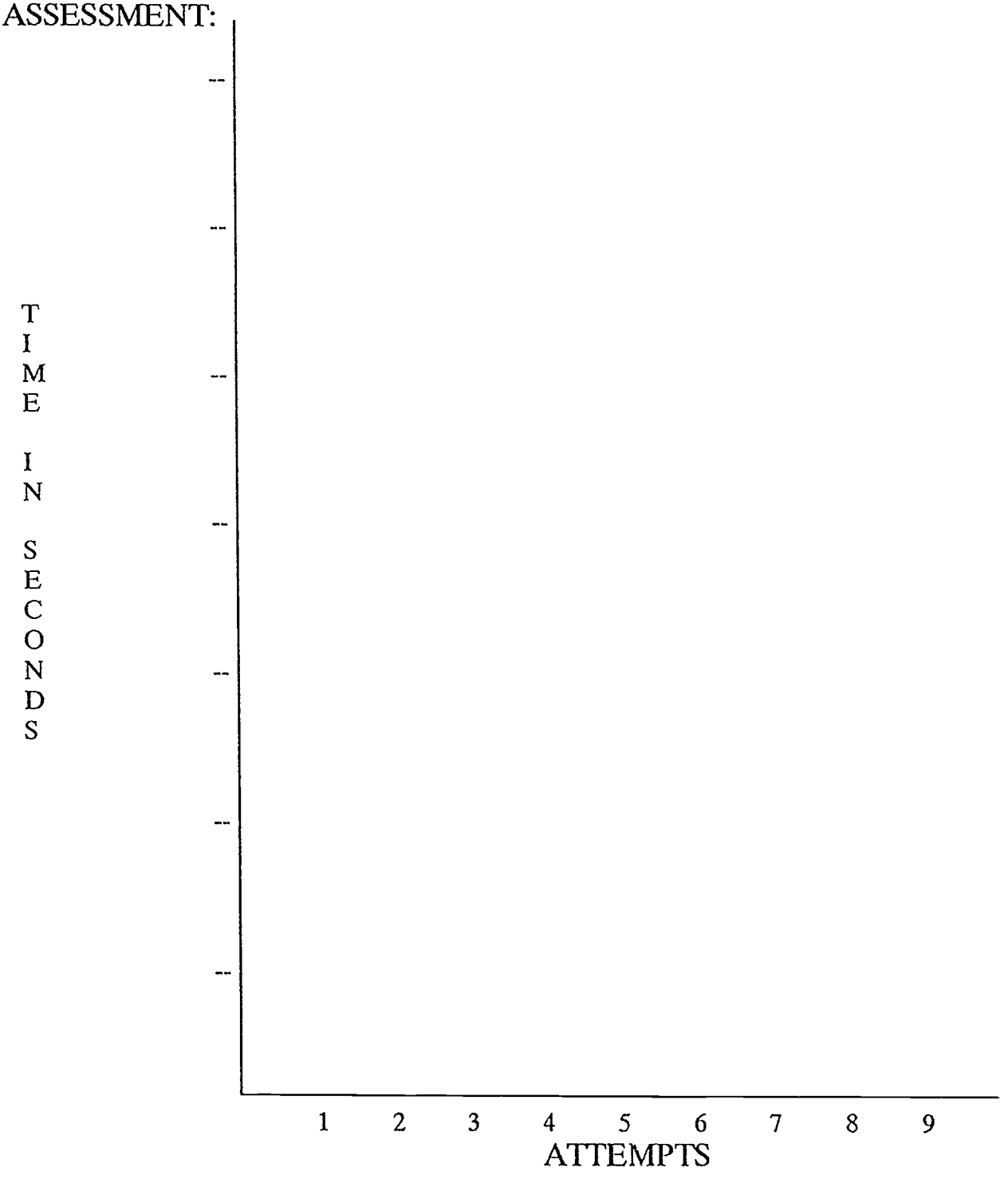
9. Discuss your process with the team members and make improvements to your process to improve your time.

10. Repeat steps 6 through 9 as often as you wish in the time allowed. Make sure that only one time is recorded for each different process improvement.

CONTINUOUS IMPROVEMENT EXERCISE

(Numbered Ball Game)

ASSESSMENT:



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" IN GOD WE TRUST,

ALL OTHERS MUST BRING FACTS. "

--- Anonymous

INDIVIDUAL RESPONSIBILITY

IN QUALITY IMPROVEMENT

- PROBLEM SOLVING
- TEAM PLAYER
- ROLE MODEL
- PROCESS LOOK
- BUY/IN - EMPOWERED
- OWNERSHIP
- EDUCATION

--- Texas Instruments, Quality Improvement Workshop

" QUALITY IMPROVEMENT IS A TOOL,

NOT A PANACEA. "

--- Dr. Russell Ackoff, Governor's Conference on Quality and Education, 1992

Quote39

Problem Solving or Quality Improvement Process: Which One?

Problem Solving Process		Quality Improvement Process
A general process for making a change in • systems • work process • management process • results • conditions		**A tightly-focused process** for ensuring conformance of • a specific product or • a specific service to the requirements of its customers.
• definition of problems • analysis of data • understanding of causes • creative ideas • more alternatives • teamwork • commitment	The process fosters	• elimination of unneeded work • prevention of problems • shared responsibility • strong customer/supplier communication lines • evaluation of work processes • critical measurement • confidence in results
• there is a gap between what is happening and what you want • you want to move from a vague dissatisfaction to a solvable, clearly-defined problem • you're not sure how to approach an issue	Use it when	• you need to improve the quality of a particular, currently existing output • you don't have agreed-upon customer requirements for an output • you are about to produce a new output, the need for which has recently been determined
• problem you identify is a lack of quality or an inability to assess quality • the recommended solution involves producing a specific output Then go to Quality Improvement Process	One process can lead to the other when	• evaluation of process capability shows that current work process cannot produce an output that meets customer requirements • evaluation of results indicates that the work process did not produce a quality output Then go to Problem Solving Process

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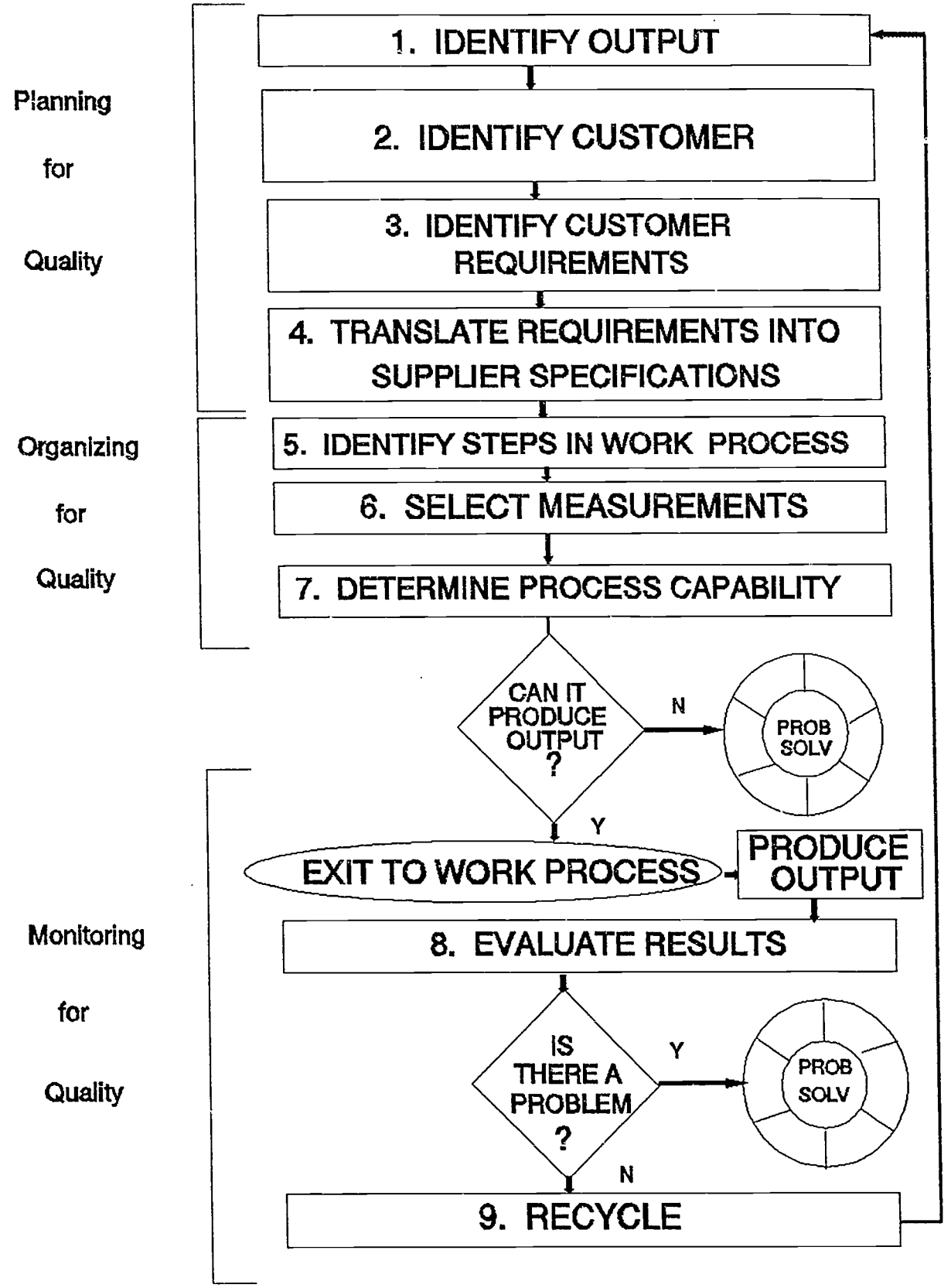
QUALITY IMPROVEMENT PROCESS



QUALITY IMPROVEMENT PROCESS

PLANNING FOR QUALITY: STEPS 1-4

QUESTIONS TO BE ANSWERED:

- What is to be done?
- For whom is it to be done?
- What is wanted, needed, or expected?
- Is it measurable, realistic, and achievable?

RESULTS TO BE ACHIEVED:

- Come to agreement--by both customer and supplier--on customer requirements
- Increase the likelihood that things will be done right the first time
- Eliminate activities for which there is no clearly identified customer or need
- Reduce likelihood of doing too much, or too little, based on assumptions of what the customer wants or needs
- Eliminate activities with limited potential payback before they start
- Ensure the right of the supplier to question the customer about requirements
- Increase confidence that those identified as customer and supplier are the appropriate ones to address the task

QUALITY IMPROVEMENT PROCESS

ORGANIZING FOR QUALITY: STEPS 5-7

QUESTIONS TO BE ANSWERED:

- How will it be accomplished?
- What must be measured to ensure that it is successfully accomplished?
- Is the work process capable of delivering what is expected?

RESULTS TO BE ACHIEVED:

- Ensure that measurement is meaningful, not just for its own sake
- Shift emphasis from inspection to prevention
- Enhance probability of meeting customer requirements
- Provide clearer identification of content, sequence, timing, and resource requirements of job tasks
- Enhance likelihood that process changes will be made before major problems occur

QUALITY IMPROVEMENT PROCESS

MONITORING FOR QUALITY: STEPS 8-9

QUESTIONS TO BE ANSWERED:

- Are changes required in the process?
- Where are there additional opportunities for quality improvement

RESULTS TO BE ACHIEVED:

- Ensure a clearer understanding of current level of performance
- Improve ability to isolate problem causes
- Establish quality improvement as a moving target

PROCESS IMPROVEMENT

SIX STEP PROCESS:

STEP 1: DEFINE THE PROBLEM

STEP 2: IDENTIFY AND DOCUMENT THE PROCESS

STEP 3: MEASURE PERFORMANCE

STEP 4: UNDERSTAND WHY

STEP 5: DEVELOP AND TEST IDEAS

STEP 6: IMPLEMENT SOLUTIONS AND EVALUATE

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 1: DEFINE THE PROBLEM

- Identify output
- Identify customers
- Define requirements
- Identify processes
- Identify process owner

STEP 2: IDENTIFY AND DOCUMENT THE PROCESS

- Flowchart
- Model
- Identify participants

STEP 3: MEASURE PERFORMANCE

- Customer satisfaction
- Customer requirements
- Output delivered
- Process parameters
- Cost of quality

STEP 4: UNDERSTAND WHY

- Distinguish major causes
- Diagnose root causes
- Understand variation: common causes, special causes, capability

STEP 5: DEVELOP AND TEST IDEAS

- Develop new ideas
- Experiment
- Test ideas to address root causes

STEP 6: IMPLEMENT SOLUTIONS AND EVALUATE

- Plan improvements
- Implement system changes
- Document system changes
- Evaluate system performance
- Evaluate six steps
- Reward participants
- Recycle to step 1

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 1: DEFINE THE PROBLEM:

1. **Identify the process output(s) which require(s) improvement.**

2. **Identify the customers of the process outputs which require improvement.**

3. **Define the customer requirements.**

4. **Identify the processes which are producing these outputs.**

5. **Identify the owner(s) of the processes.**

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 2: IDENTIFY AND DOCUMENT THE PROCESS:

1. The use of a flowchart is a useful way to document the process.

Use of a flowchart enables the following improvement activities to be performed:

- Identify the participants in the process, either by name or by organization.
- Provide all participants in the process with a common understanding, both of all steps in the process and of their individual roles.
- Identify inefficient, wasteful, and redundant steps.
- Offer a framework for defining process measurements.

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 3: MEASURE PERFORMANCE:

1. **Measuring customer satisfaction is the highest level of measurement and represents the ultimate desired result.**

2. **Understand the customer requirements and measure how well the process is designed to meet the requirements.**

3. **Does the output of the process meet the actual requirements of the customer?**

4. **Measure the individual process steps or activities within the process.**

5. **The "cost of quality" is a good measure of process performance.**
   - How much is poor quality costing?
   - How much is spent to insure good quality?

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

MEASURING PROCESS PERFORMANCE: (THREE LEVELS)

LEVEL 1: PROCESS

PERFORMANCE PARAMETERS:

- Measure each step/activity in the process.
- Measure the characteristics of inputs delivered by suppliers that control the output.
- Use these measurements to control operations and to predict the outputs before they are produced or delivered.

LEVEL 2: OUTPUT

REQUIREMENTS:

- Define the specific features, values, characteristics, and attributes desired by the customers.
- These requirements and expectations must be translated into product/service specifications.

CAPABILITY:

- In direct correspondence to every special feature, value, characteristic, and attribute desired by the customer, measure its level in each product or service delivered by the process.
- These measurements represent the voice of the process and define what the process has delivered.

LEVEL 3: OUTCOME

CUSTOMER SATISFACTION: (Highest level of measurement and represents the ultimate desired result.)

- Measure how well each product or service satisfies the needs and expectations of the customer. (Recognize that these measurements are based on vague,idiosyncratic perceptions.)
- Outcomes are beyond the direct control of the supplier.
- These measures often trigger process improvement initiatives.

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

If This is Your focus...	.... Then This is Who You Need to Please	.... and These Are Key Measurements
Customer	Students	o Student satisfaction o Ability of students to succeed in career or higher education
Shareholder	Parents Administration School Board Taxpayers	o Student success after graduation o Interim student assessments o Student behavior o Financial indicators o Goals and objectives defined by mgmt.
Employee	Employees	o Employee satisfaction o Factors contributing to job satisfaction
Community	Government agencies Social services Local community The media	o Regulatory compliance o Factors impacting on society o Positive image

process improvement6

PROCESS IMPROVEMENT

MEASUREMENT GUIDELINES:

ESSENTIAL VARIABLES OF MEASUREMENT SYSTEMS:

1. Simplicity of presentation (few and understandable)
2. Visibility
3. Involvement of all concerned
4. Undistorted collection of primary information throughout the operations area
5. Straightforward measurement of what's important
6. Achievement of an overall feeling of urgency and perpetual improvement

-- Tom Peters, Thriving on Chaos

PROCESS IMPROVEMENT

MEASUREMENT GUIDELINES:

TOOLS FOR IMPLEMENTING MEASUREMENT SYSTEMS:

1. Programs have strong support from top management.

2. Programs are developed through the inclusion of employees who will be measured.

3. Programs include measures that employees and managers need to do their jobs.

4. Managers demonstrate the impact of measures through linkage to the compensation and reward systems.

-- W.H. Davidow and B. Uttal, Total Customer Service

PROCESS IMPROVEMENT

STEP 4: UNDERSTANDING WHY:

1. Have we found the vital few from the trivial many?

- Juran's concept that 80% of the problems are due to 20% of the causes.

- Use Pareto analysis to categorize causes to find vital few.

2. Have we diagnosed the root causes?

- Ishikawa suggests that the first signs of a problem are its symptoms, not its causes. Actions taken on symptoms cannot be permanently effective.

- Use cause-and-effect diagrams (fishbone charts) to determine root causes to problems.

3. Do we understand the sources of variation?

- Common causes are inherent within a system and yield random variation within predictable bounds. Common causes can only be solved by addressing the underlying system.

- Special causes are assignable to specific reasons or events and result in sporadic variation that defies prediction. Special causes are addressed by eliminating their specific, identifiable source.

- Process capability is defined as the ability of a process to meet the specifications (customer requirements). It can be calculated and can be visualized by plotting histograms.

-- Arthur Tenner and Irving DeToro, Total Quality Management

ROOT CAUSE ANALYSIS

EXAMPLE:

LEVEL	OBSERVATION	ACTION	OUTCOME
Symptom	Car does not start	Call tow truck	$25 bill for jump start
Cause	Dead battery	Recharge by driving	Arrive at work (late)
Cause	Broken fan belt	Call tow truck (again)	$50 bill for jump start and belt replacement
Root Cause	Inadequate preventative maintenance	Implement manufacturer's recommended service	Problem eliminated

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 5: DEVELOP AND TEST IDEAS:

1. **Develop new ideas for improving the process.**

   - Ideas for improvement must address the root cause of the problem.
   - What are new and different ways to design and operate the process to eliminate root causes?

2. **Design and conduct experiments to test the hypotheses developed in Step 4.**

   - Also, design experiments to test the ideas developed in Step 5 before implementing them.

3. **When tests fail to produce the desired results, determine the cause.**

   - Was the test valid?
   - Was the improvement idea effective?
   - Were you mistaken about the root causes of the problem?
   - Were measurements inaccurate or taken on the wrong parameters?
   - Was the process completely identified?
   - Were the customer's requirements misunderstood?

Recycle back to the appropriate step on the process improvement road map.

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT

STEP 6: IMPLEMENT SOLUTIONS AND EVALUATE

1. Plan improvements. (methodology and schedule)

2. Implement system changes.

- Insure proper communications with affected people.

3. Document system changes.

- Necessary in order to properly evaluate results.
- Necessary to make the change an integral part of the process.

4. Evaluate system performance.

- Monitor, measure, and evaluate those outputs or measurements that were expected to be improved.

5. Evaluate six steps.

- Review each of the six steps of the improvement process to insure they were properly executed.

6. Reward participants.

- Recognition is critical
- Recognition should be sincere and recognize all participants.
- Recognition should be given as soon after successful implementation as possible. Make sure results justify recognition.

7. Recycle to Step 1.

- Start the process over again.
- Remember that process improvement is a continuous cycle. It is a journey, not a "one time" process.

-- Arthur Tenner and Irving DeToro, Total Quality Management

PROCESS IMPROVEMENT EXAMPLE

The algebra II teachers in Banner High School found that many students entering their classes were not adequately prepared. These teachers were having to spend six weeks in remediation in order to prepare the students for algebra II.

These teachers had completed TQM training, therefore they decided to use the "process improvement" process to improve the preparedness of incoming students.

They used the six step process as identified by Arthur Tenner and Irving DeToro in their book, Total Quality Management.

STEP 1: DEFINE THE PROBLEM

1. Students entering algebra II class need to have eight basic competencies.

2. The algebra II teachers are the customers of the process outputs that require improvement.

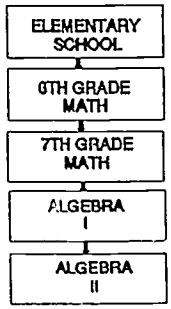
3. 100% of entering students must have mastered eight basic competencies.

4. Four middle school algebra I programs are sending students to Banner High School.

5. The math coordinators at each of the middle schools are the owners of the processes.

STEP 2: IDENTIFY AND DOCUMENT THE PROCESS

The process is the same for each middle school:



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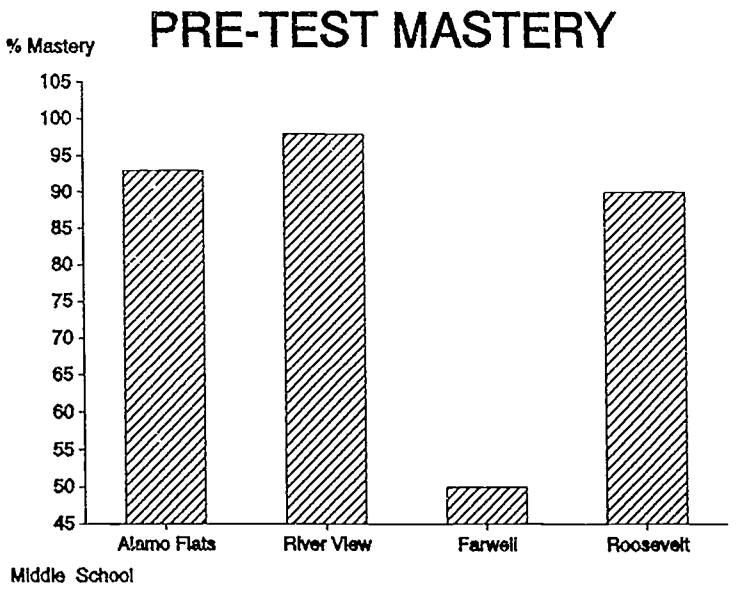
STEP 3: MEASURE PERFORMANCE

The algebra II teachers developed a pre-test to measure mastery of the eight basic competencies. They determined that 20% of all incoming students did not master one or more of these competencies.

The teachers were having to spend 6 weeks to enable the students to master all eight competencies. This caused boredom for many who already had mastered the subjects. It also caused the teachers to rush through their course and spend less time than they needed on critical applications and problem solving techniques.

STEP 4: UNDERSTANDING WHY

The teachers took the pre-test scores and divided the students by the middle school they attended. The results are shown below:



Using root cause analysis, the teachers found that none of the algebra I classes at Farwell Middle School taught three of the competencies.

STEP 5: DEVELOP AND TEST IDEAS

The Banner High School teachers worked with their counterparts at Farwell Middle School to add the three competencies to their curriculum. They also agreed to develop a post-test for the algebra I teachers at Farwell to use which was equivalent to the pre-test they were using at Banner.

After the next year, 96% of the Farwell students passed the post-test at Farwell. 97% of these same students were able to pass the pre-test when they went to Banner in the fall.

STEP 6: IMPLEMENT SOLUTIONS AND EVALUATE

As a result of this process improvement investigation, the post-test was implemented at all four middle schools. The school district also implemented a semi-annual curriculum meeting between all high school and middle school math teachers.

The Banner teachers have taken on new improvement efforts to increase the pre-test mastery to 100%.

PROCESS IMPROVEMENT

COMMON PITFALLS TO PROCESS IMPROVEMENT:

- **TAMPERING:** Is the project targeted for one specific nonconformance or incident when the underlying process is incapable of achieving the required results?

- **INCOMPLETE OWNERSHIP:** Have all stakeholders been identified and include in the project as appropriate, or have some been missed: process owner, participating employees, customers, suppliers?

- **LACK OF EXPERTISE:** Is a team of novices being asked to address an issue normally within the domain of acknowledged experts, specialists, or consultants?

- **IMPOSED SOLUTION:** Is a "quality action team" being used as a disguise to implement a solution predetermined by management without understanding the fundamental underlying causes?

- **CONSTRAINTS:** Is the project artificially constrained by expectations established before the underlying causes have been identified (e.g., technical expertise, data, cost, schedule)?

- **WORLD HUNGER:** Is the objective so broad, the situation so deeply ingrained in your culture, or ownership so diffuse that the current level of competence in quality improvement unlikely to be successful?

-- Arthur Tenner and Irving DeToro, Total Quality Management

" IF WE'RE STANDING STILL,

WE'RE MOVING BACKWARDS. "

--- Sam Walton

CONTINUOUS IMPROVEMENT

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